‘Lisbon’ Lemon Selection Trials in Arizona – 2008-09 and 2009-10[1]

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Abstract

Four 'Lisbon' lemon selections, 'Frost Nucellar', 'Corona Foothills', 'Limoneira 8A' and 'Prior' were selected for evaluation on Citrus volkameriana rootstock. Yield was adequate for 2008-09 and 2009-10, and suggests that 'Limoneira 8A Lisbon' and ‘Corona Foothills Lisbon’ are superior to the other two selections tested.

Introduction

There is no disputing the importance of citrus scion cultivar selections to desert citrus production. A successful citrus selection must be adaptable to the harsh climate, must be vigorous and must produce high yields of good quality fruit.

Lemons are the most important citrus grown in Arizona today. Today, lemons comprise 70% of all harvested citrus acreage in the state. When the Arizona lemon industry was established in the 1950’s the principal variety was the ‘Desert Lisbon’. No records exist as to the characteristics of this variety. Within a few years however, ‘Desert Lisbon’ was eclipsed in popularity by ‘Frost Nucellar Lisbon’ the only nucellar clonal selection of the ‘Lisbon’ variety. Other popular selections of ‘Lisbon’ that have been planted in Arizona include ‘Monroe’, ‘Limoneira 8A’, ‘Prior’, and ‘Rosenberger’. Popular lemons common to Arizona that are not ‘Lisbon’ include ‘Allen Eureka’ and ‘Corona Foothills’ (also known as Foothills), a selection of ‘Villafranca’. All of these represent selections of outstanding trees that were then propagated. All are identified by their originator or place of origin, and are characterized by high vigor, high productivity, precocity (trees bear at an early age), earliness (a high percentage of the fruit can be harvested before 15 November), short thorns and good fruit quality. However, there is a certain amount of variability among lemon clonal selections.

As the Arizona lemon industry has found itself a marketing niche for the late summer and fall harvest, tree qualities such as high productivity, good fruit quality and early season size are important. Selections that have not met these standards have been superseded by selections that have these characteristics. Consequently, by 1992, the most popular clonal lemon selection grown in Arizona was the ‘Limoneira 8A Lisbon’. This selection originated in Santa Paula, CA, exhibits high productivity, precocity, earliness, and has adequate fruit quality. Other ‘Lisbon’ selections still grown in Arizona include ‘Prior’ and ‘Frost Nucellar’. ‘Corona Foothills’ is a more recent introduction that originates in Corona, CA. This selection purportedly originates from ‘Villafranca’, has fruit that is indistinguishable from ‘Eureka’, but has a winter distribution of the crop, similar to ‘Lisbon’. “Corona Foothills has a reputation for high productivity and good fruit quality. Therefore, we planted the first ‘Lisbon’ lemon selection trial in 1993

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including ‘Limoneira 8A Lisbon’, ‘Prior Lisbon’, ‘Frost Nucellar Lisbon’, and ‘Corona Foothills Lisbon’ lemon on *C. volkameriana* as the rootstock. Previous results from this trial have been reported in previous issues of the Citrus Research Report

Materials and Methods

This trial was established in March 1993 in Block 26 of the Yuma Mesa Agricultural Center, near Yuma, Arizona. The land was laser leveled and fumigated prior to planting. Trees were planted on a 10-m x 10-m spacing. Twelve replicates of each of the 4 scions were planted for a total of 48 trees. Experimental design is randomized complete block.

Irrigation is border flood, and normal cultural practices are used. For several years, leaves were collected annually in August for mineral analysis; however, there were no significant differences in leaf nutrient content, so that practice has been stopped.

Yield data is typically collected during the fall and winter. For 2008-09, trees were harvested using a ring on 10-14-08 then the trees were stripped of fruit on 1-30-09. For 2009-10, the ring harvest was 10-9-09 and the final harvest was 1-15-10. For each harvest date, the entire yield was estimated by the number of 65-lb. picking sacks harvested per tree. For the first harvests of both seasons, about 35 lbs. per tree of harvested fruit from each tree per harvest was passed through an automated electronic eye sorter (Autoline, Inc., Reedley, CA), which provides weight, color, exterior quality and size data (packout) for each fruit. Fruit packout data is reported on a percentage basis.

All data was analyzed using SPSS 11.0 for Windows (SPSS Inc., Chicago, Illinois).

Results

Yields for this experiment, since the trees have been bearing, are shown in Figure 1. Counting only the ten years beginning with 1998-99, when yields of these trees first surpassed 100 lbs per tree, ‘Limoneira 8A’ has ranked first or second in annual yields 12 times (each year except 2002-03, when it placed a close third), Corona Foothills has ranked first or second nine times (each year except 2003-04, 2006-07 and 2007-08, the latter 2 being close third), ‘Frost Nucellar’ has ranked first or second three times (in 2002-03, 2003-04 and 2006-07), and ‘Prior’ has ranked first or second only twice (2000-01 and 2007-08). From 1998 to 2007, ‘Limoneira 8A’ has averaged 369 lbs. of fruit per tree, while ‘Corona Foothills’ has averaged 351 lbs. of fruit per tree. At our spacing of 30 x 30 feet, this difference corresponds to 16 field boxes per acre. Meanwhile, ‘Prior’ and ‘Frost Nucellar’ have averaged 307 and 304 lbs of fruit per tree, respectively.

Yields for the 2008-09 harvest season are shown in Figure 2. Compared to the previous year (Fig. 1), yields for trees on all the selections tested decreased slightly. This decrease can be attributed to tree age and the effects of disease and nematodes. It is worth noting that seven trees of the original 48 have been lost to Antrodia brown wood rot, three of ‘Frost Nucellar’, two of ‘Prior’ and two of ‘Corona Foothills’.

There were no significant differences in yield between the selections tested for the 2008-09 first harvest. First harvest yields ranged from 45 lbs per tree for the ‘Prior’ to 80 lbs per tree for ‘Corona Foothills’. For the second harvest, there were significant differences among the selections. Second-harvest yields ranged from 144 lbs per tree for ‘Prior’ to 234 lbs. per tree for ‘Limoneira 8A’. This spread was significant. Yields of ‘Corona Foothills at 220 lbs and ‘Frost Nucellar at 190 lbs were intermediate. Significant differences in annual yield were also apparent among the selections. ‘Corona Foothills’ had the greatest annual yield of 300 lbs. per tree. This quantity was not significantly different than the 293 lbs. per tree recorded for ‘Limoneira 8A’ (98% of the yield of ‘Corona Foothills’), or the 244 lbs. per tree recorded for ‘Frost Nucellar (81% of the yield of ‘Corona Foothills’). The annual yield for ‘Prior’ of 190 lbs. (63% of the yield of ‘Corona Foothills’) was significantly less than the annual yield of ‘Corona Foothills’.

There were no significant differences in first, second or total yields for the 2009-10 harvest (Fig. 3). For the first harvest, yields ranged from 99 lbs per tree for 'Corona Foothills' to 62 lbs per tree for 'Frost Nucellar'. For the second harvest, yields ranged from 246 lbs per tree for 'Limoneira 8A' to 202 lbs per tree for 'Frost Nucellar'. Overall yield for the 2009-10 season was 329 lbs for 'Corona Foothills', 308 lbs for Limoneira 8A', 298 lbs for 'Prior' and 265 lbs for 'Frost Nucellar'.

Packout for the 10-14-08 harvest is shown in Figure 4. All the selections peaked on sizes 140 and 165, except 'Frost Nucellar' which peaked on sizes 165 and 200. The only significant effect was that 'Frost Nucellar had less fruit of size 140 than did the other selections. Packout for the 10-9-09 harvest is shown in Figure 5. All the selections peaked on sizes 115, 140 and 165. There was no significant difference in packout for 2009-10 among the selections.

There was no difference in fruit shape, color or exterior quality between the selections for any of the harvests (data not shown).

Discussion and Conclusions

For the selections, both 'Limoneira 8A' and 'Corona Foothills' still appear to be superior to the other selections tested. Yields for 'Limoneira 8A' were the greatest for the first seven years of this sixteen-year study. Additionally, first harvest yield is generally greater for this selection, compared to the other selections tested. While for 2001-02 and 2002-03, 'Limoneira 8A' did not have the greatest yield, for 2003-04 and 2004/05, it regained the top spot, fell again into second place in 2005-06, regained the top spot in 2006-07 and 2007-08, and fell into second place in 2008-09 and 2009-10. Cumulative yield for the 'Limoneira 8A' since planting is about 4540 lbs per tree; the greatest 16-year cumulative yield for all the selections in this trial. Whether 'Limoneira 8A' will remain superior is still not known. Nonetheless, this selection is still the industry standard, and is recommended for planting.

Yield of 'Corona Foothills' has equaled or surpassed 'Limoneira 8A' for four of the past eight years, regaining the top spot in 2005-06 after two years in which it had somewhat lower yield compared to 'Limoneira 8A', losing the top spot again in 2006-07 and 2007-08, but regaining it in 2008-09 and 2009-10. Fruit size for this selection was typically to be superior to all others, as shown again for this season. For five of the first six years of this trial, this selection was inferior to 'Limoneira 8A', and this early inferiority is reflected in the cumulative yield for 'Corona Foothills' of 4250 lbs per tree; about 6% less than 'Limoneira 8A'. Based on its recent performance, this selection is still recommended for planting.

'Frost Nucellar Lisbon' performed well in 2002-03 and 2003-04; the first two years in which it has done so, but then for the next two seasons it fell back again, then regained second position in 2006-07, but fell again to last in 2007-08, regained third in 2008-09 and fell to last again in 2009-10. Before 2002-03, this selection has typically had lower, although not always significantly lower, yield than the other selections tested. Cumulative yield for 'Frost Nucellar' since the inception of this experiment is only 3700 lbs. per tree, about 19% less than 'Limoneira 8A'. Fruit size for 'Frost Nucellar' is typically smaller than 'Corona Foothills' or for 'Limoneira 8A'.

After two seasons of superior performance in 2000-01 and in 2001-02, yield of 'Prior Lisbon' was lower from 2002-03, until 2007-08, when it performed well again. This marks a departure from its lower performance typical of 1994 through 2000. However, 'Prior' regained form in 2008-09 when it fell to last place, and in 2009-10 when it was only third. Cumulative yield for this selection since the start of the experiment is 3740 lbs. per tree, about 18% less than 'Limoneira 8A'. While fruit size is often good for this selection, the lower yield for most years cannot be discounted.

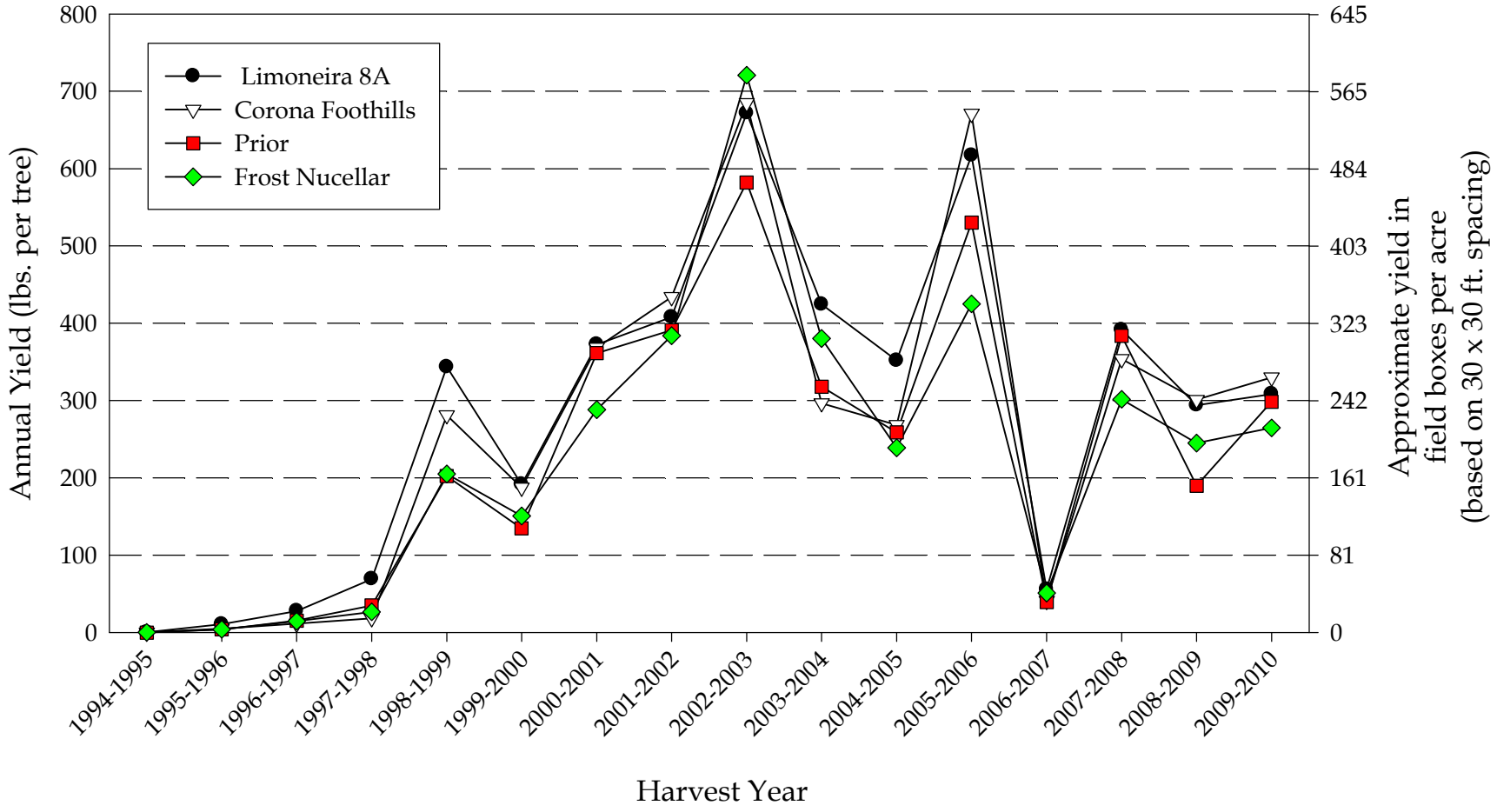

Figure 1. 1994-95 through 2009-10 yields of four lemon selections on *C. volkameriana* rootstock.

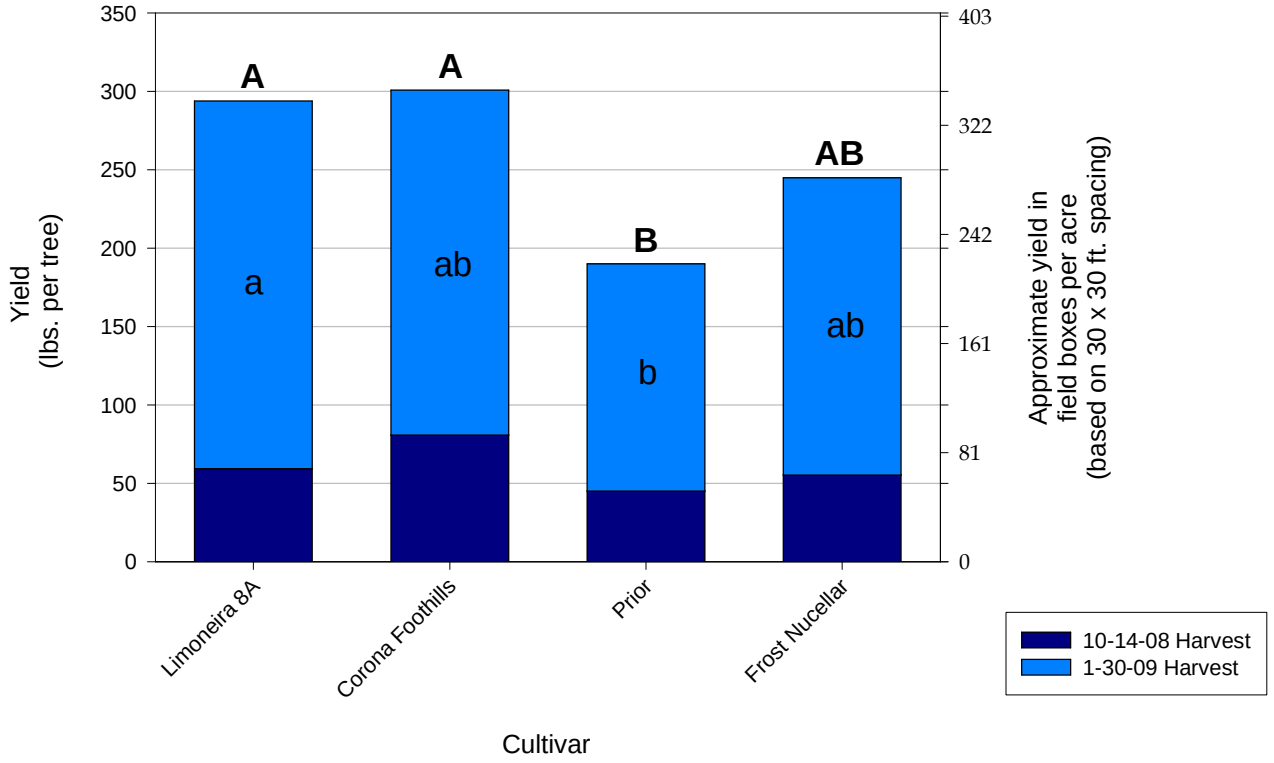

Figure 2. Yields of four lemons on *C. volkameriana* rootstocks for 2008-09. Only letters pertaining to a harvest, or capital letters for the annual yield can be compared statistically. Differing letters designate statistical differences with 95% confidence.

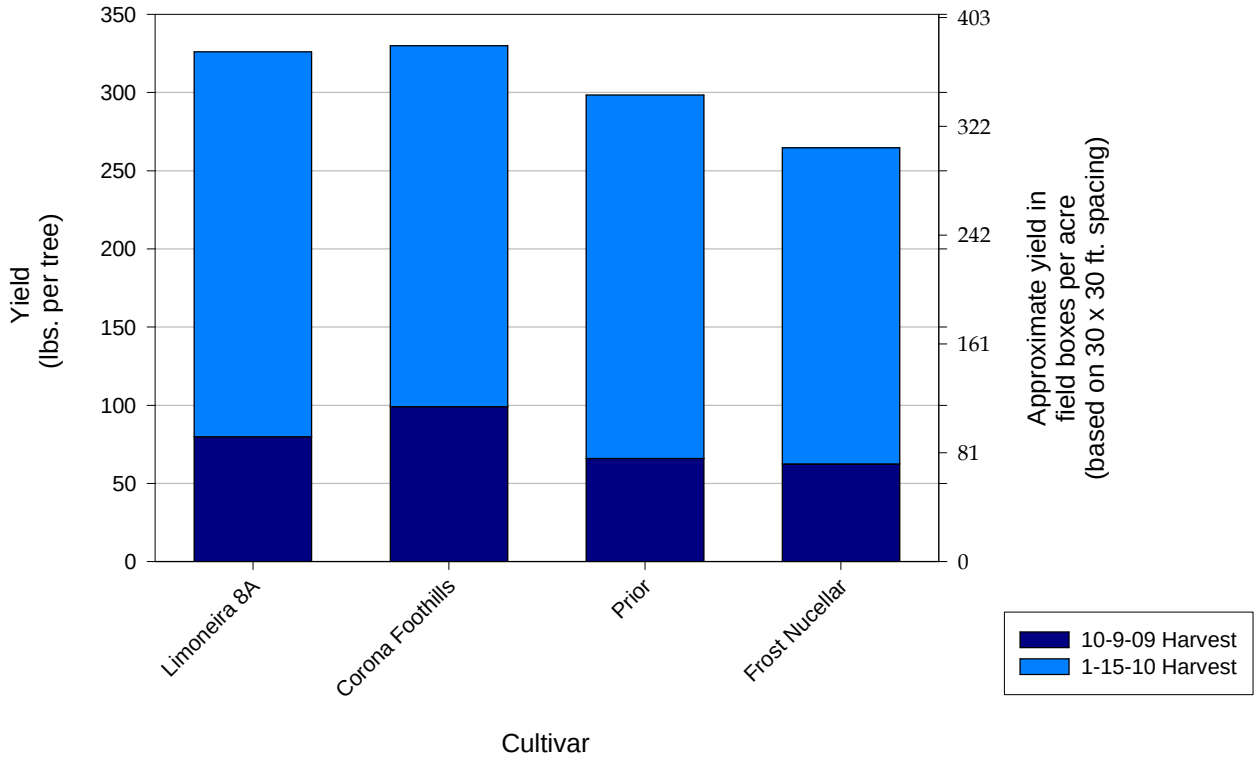

Figure 3. Yields of four lemons on *C. volkameriana* rootstocks for 2009-10. Only letters pertaining to a harvest, or capital letters for the annual yield can be compared statistically. Differing letters designate statistical differences with 95% confidence.

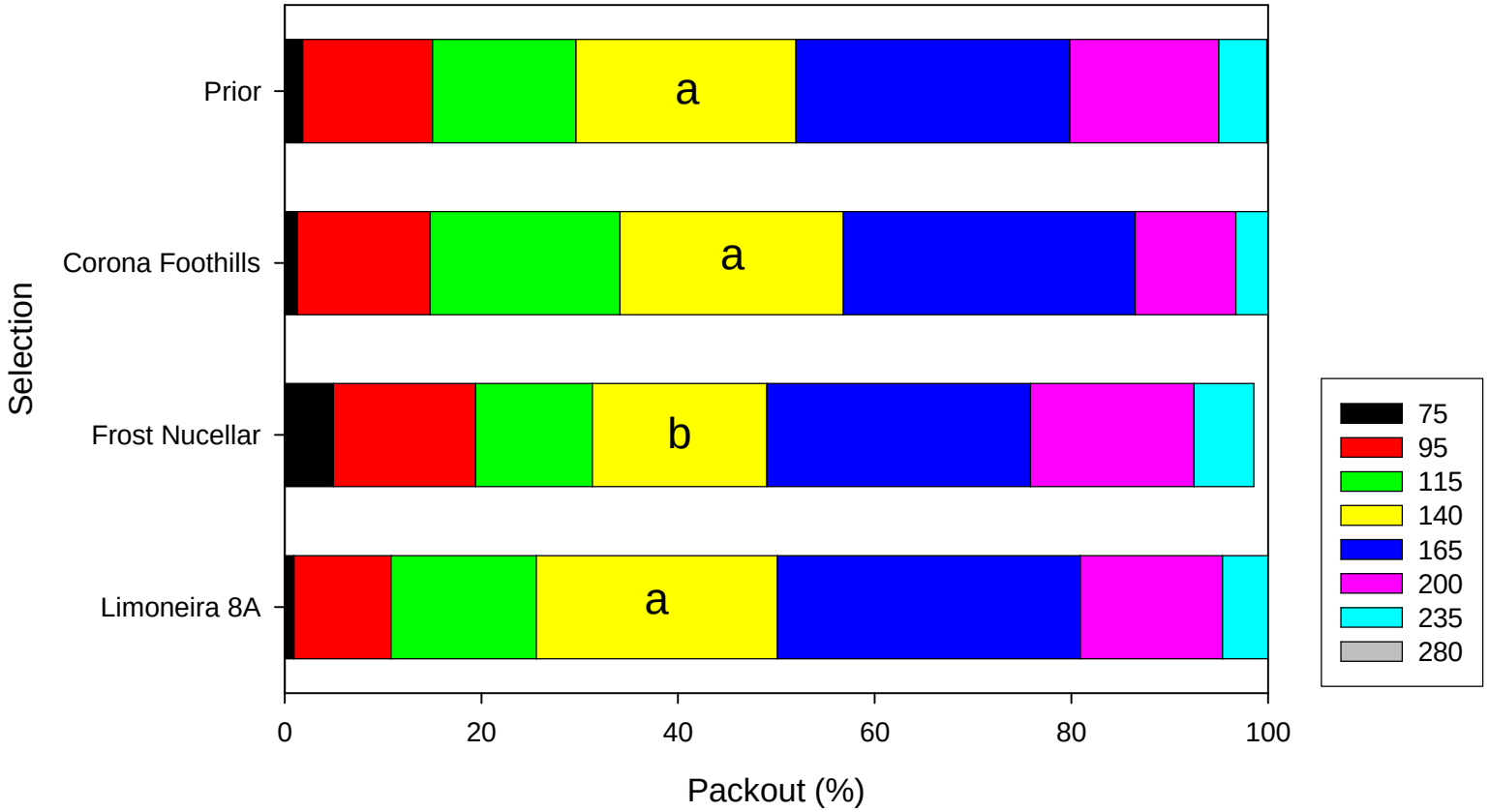

Figure 4. Packout of four lemon selections on *C. volkameriana* rootstock for the 10-14-08 harvest. Only letters within a size class may be statistically compared.

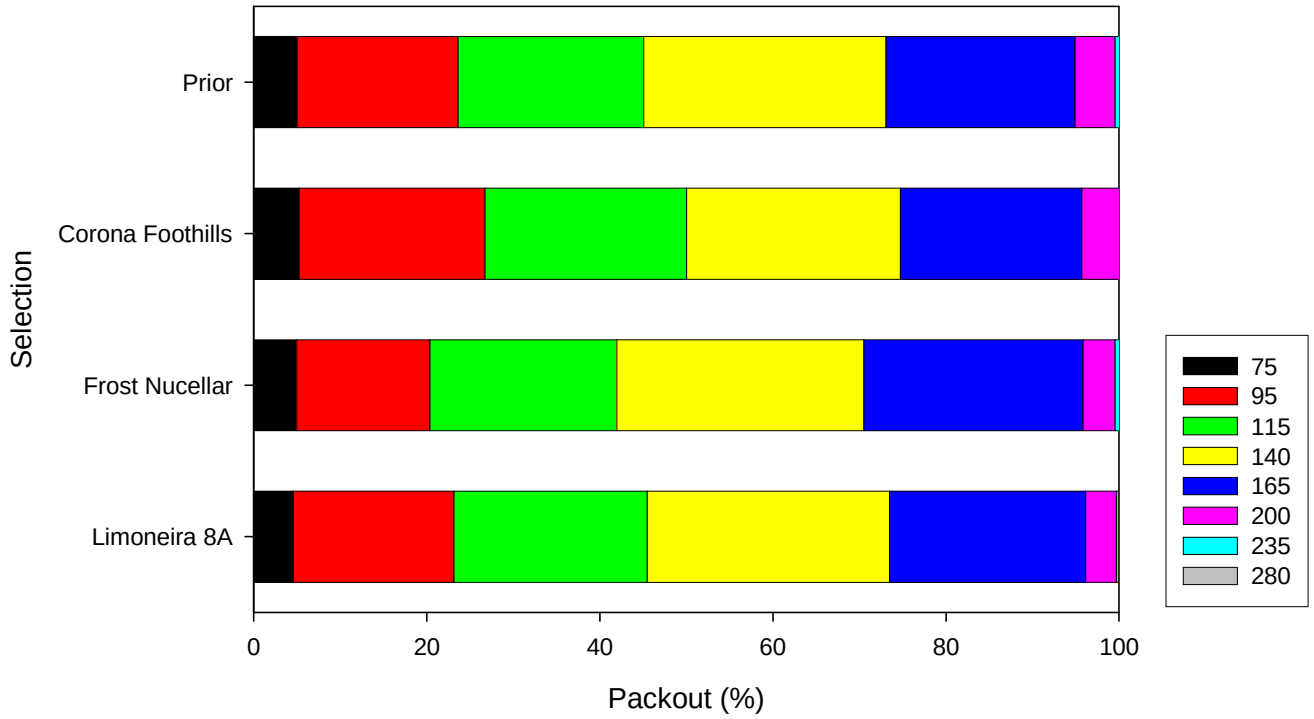

Figure 5. Packout of four lemon selections on *C. volkameriana* rootstock for the 10-9-09 harvest. There was no significant effect of the treatment upon packout.